291a Inverted Colloidal Crystals as Bone Tissue Engineering Scaffolds

Meghan J. Cuddihy, Jung Woo Lee, and Nicholas A. Kotov

In cell culture and tissue engineering, the precise design of three-dimensional scaffolds is essential for controlling nutrient diffusion, interstitial fluid and blood flow, as well as cell growth, function, and differentiation. Bone-mimicking poly(DL-lactide-co-glycolide) (PLGA) scaffolds were constructed with inverted colloidal crystal (ICC) geometry. The highly-defined and well-ordered geometry of ICC scaffolds provided an ideal environment for the co-culture of human osteoblast (hFOB 1.19) and bone marrow stromal (HS-5) cells. The ICC scaffolds were prepared by infiltration of a classical colloidal crystal made from uniformly sized soda lime microspheres, which self-assembled into a hexagonal crystal template upon slow sedimentation. The template was infiltrated with PLGA, and the spheres were subsequently dissolved. The resulting topology of the PLGA scaffold could be described as closely packed spherical cavities arranged in a hexagonal crystal lattice. This structure offered a high porosity and surface area for cell migration, growth, and attachment. Additionally, the use of an accurately controlled template allowed for full connectivity throughout the scaffold. This unique scaffold geometry provided an excellent environment for cell attachment and proliferation of a human osteoblast and bone marrow stromal cell co-culture.